A1 (Conc'd)

an optical device to which a compressed optical signal output from said first optical fiber is supplied, said optical device having a saturated gain and changing spectrum of the optical signal.

A2

17. (AS ONCE AMENDED) A system according to claim 15, wherein said optical device comprises a semiconductor optical amplifier applying a gain saturated in concert with an increase in input power to said optical signal. 102

18. (AS ONCE AMENDED) A system according to claim 17, wherein said optical device further comprises a light source supplying assist light having a wavelength different from the wavelength of said optical signal to said semiconductor optical amplifier. O

A3

20. (AS ONCE AMENDED) A system according to claim 19, wherein said optical device further comprises a light source supplying assist light having a third wavelength different from said first wavelength to said DFB laser. O

REMARKS

In the Office Action mailed November 22, 2002, claims 1, 2, 4, 5, 6, 7, 8, 15, 16, 22, 23, and 25 were rejected under 35 U.S.C. 103 as being unpatentable over Saito ("Prechirp Technique for Dispersion Compensation for a High-Speed Long-Span Transmission", IEEE Photonics Technology Letters, Vol. 3, No. 1, January 1991), claims 9, 10, and 26 were rejected under 35 U.S.C. 103 as being unpatentable over Saito in view of Naito et al. (U.S. Patent No. 5,777,770), claims 13, 17, 18, and 21 were rejected under 35 U.S.C. 103 as being unpatentable over Saito in view of Freeman (U.S. Patent No. 6,236,498) and further in view of Lowry (presumably "Signal Speed Gets Boost from Tiny Amplifier", http://www.llnl.gov/str/Lowry.html), and claims 19 and 20 were rejected under 35 U.S.C. 103 as being unpatentable over Saito in view of Schimpe (U.S. Patent No. 5,184,247). The foregoing rejections are respectfully traversed.

It is noted that Schimpe is not listed on any Form PTO-892 presented by the Examiner, even though the Examiner is relying upon Schimpe to reject claims in the Action. It is respectfully requested that the Examiner list Schimpe (U.S. Patent No. 5,184,247) as a cited

reference on Form PTO-892 and forward a copy of same to the undersigned.

In accordance with the foregoing, claims1-15, 17, 18, and 20 have been amended. Claims 1-27 are pending and under consideration.

Claims 2-10, 12, 14, 17, 18, and 20 are amended for clarification.

Saito discloses prechirp transmission equipment transmitting a prechirped waveform through a negative dispersion fiber. In the Saito apparatus, high frequency components of the waveform are transmitted faster than low frequency components. Saito does not discuss or suggest an optical fiber connected to a device that has a saturated gain, as in the present invention.

Naito discloses an optical phase conjugator and optical reception apparatus and an optical transmission apparatus for use with an optical communication system employing the optical phase conjugator.

Freeman discloses upgradable, gain flattened fiber amplifiers for WDM applications. As shown in Fig. 1 and disclosed in col. 3 of Freeman, the output of WDM/isolator is input to gain flattening filter 24, the output of which is coupled to the input of optional intermediate power fiber amplifier stage 16.

Lowry discusses introducing a laser into a semiconductor optical amplifier waveguide, and, thus clamping signal gain at a specific level.

Schimpe discusses an optically stabilized feedback laser.

Saito in view of Naito is prechirp transmission equipment transmitting a prechirped waveform through a negative dispersion fiber and having an optical phase conjugator.

Saito in view of Freeman and Lowry is prechirp transmission equipment transmitting a prechirped waveform through a negative dispersion fiber and having gain flattened fiber amplifiers for WDM applications including a laser introduced into a semiconductor optical amplifier waveguide.

Saito in view of Schimpe is prechirp transmission equipment transmitting a prechirped waveform through a negative dispersion fiber, with an optically stabilized feedback laser.

In the present invention, an optical device changes spectrum of a supplied optical signal.

According to this feature of the present invention, a simple all-optical waveform shaper not dependent on the bit rate or pulse shape of signal light is provided by using an optical device having a saturated gain.

For example, by setting the peak power of the optical signal to be supplied to the optical device to a value higher than the threshold Ps-out as shown in Figure 5 of the present application, the top of each pulse can be flattened to thereby waveform-shape the optical signal. In general, a highest-speed modulation component tends to be included near the peak of a pulse compressed on the time axis. Accordingly, a signal spectrum can be changed (that is, narrowed) by waveform shaping using the optical device. The waveform distortion due to dispersion becomes quite large in proportion to the square of spectral broadening (bit rate), so that the narrowing of the signal spectrum can reduce the waveform distortion to thereby increase a transmission distance.

Each of independent claims 1, 11, 13, and 15 of the present application (as amended) recites (using the recitation of method claim1 as an example) "an optical device having a saturated gain" and "changing, by the optical device, spectrum of the optical signal".

The cited references, either alone or in combination, do not discuss or suggest the feature of the present invention that the optical device changes spectrum of the supplied optical signal.

Dependent claims 2-10, 14, 17, 18, and 20 recite patentably distinguishing features of their own. For example, claim 3/1 recites "providing at least one optical amplifier along said first optical fiber", and "adjusting the peak power of said compressed optical signal so that the peak power becomes higher than a threshold power giving said saturated gain".

Withdrawal of the foregoing rejections is respectfully requested.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

Serial No. 09/637,640

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: April 22, 2002

By:
Gene M. Garner II
Registration No. 34,172

700 Eleventh Street, NW, Suite 500
Washington, D.C. 20001
(202) 434-1500

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please AMEND the following claims:

1. (ONCE AMENDED) A method comprising [the steps of]:

(a) providing a first optical fiber having dispersion;

(b) supplying an optical signal to said first optical fiber so that said optical signal is compressed on the time axis as propagating in said first optical fiber; [and]

(c) supplying a compressed optical signal output from said first optical fiber to an optical device having a saturated gain; and

(d) changing, by the optical device, spectrum of the optical signal.

2. (ONCE AMENDED) A method according to claim 1, further comprising [the step of] supplying an optical signal output from said optical device to a second optical fiber.

3. (ONCE AMENDED) A method according to claim 1, further comprising [the steps of]:

providing at least one optical amplifier along said first optical fiber; and

adjusting the peak power of said compressed optical signal so that the peak power becomes higher than a threshold power giving said saturated gain.

4. (ONCE AMENDED) A method according to claim 1, wherein:

the dispersion of said first optical fiber is normal dispersion; and

said [step] (b) includes [the step of] performing prechirping so that said optical signal has down-chirp.

5. (ONCE AMENDED) A method according to claim 1, wherein:

the dispersion of said first optical fiber is anomalous dispersion; and

said [step] (b) includes [the step of] performing prechirping so that said optical signal has up-chirp.

6. (ONCE AMENDED) A method according to claim 1, wherein said [step] (b) includes [the step of] suitably setting the dispersion of said first optical fiber and the power of said optical signal.

7. (ONCE AMENDED) A method according to claim 1, further comprising [the step of] providing a dispersion compensator for compensating the dispersion of said first optical fiber along said first optical fiber.

8. (ONCE AMENDED) A method according to claim 2, further comprising [the step of] providing a dispersion compensator for compensating the dispersion of said second optical fiber along said second optical fiber.

9. (ONCE AMENDED) A method according to claim 1, further comprising [the step of] providing an optical phase conjugator in the vicinity of a point where the dispersion of said first optical fiber is substantially equally divided.

10. (ONCE AMENDED) A method according to claim 2, further comprising [the step of] providing an optical phase conjugator in the vicinity of a point where the dispersion of said second optical fiber is substantially equally divided.

11. (ONCE AMENDED) An optical device to which an optical signal compressed on the time axis as propagating in an optical fiber is supplied, comprising<u>:</u>

a semiconductor optical amplifier [for] applying a gain saturated in concert with an increase in input power to said optical signal<u>, wherein spectrum of the optical signal is changed by the semiconductor optical amplifier</u>.

12. (ONCE AMENDED) An optical device according to claim 11, further comprising a light source [for] supplying assist light having a wavelength different from the wavelength of said optical signal to said semiconductor optical amplifier.

13. (ONCE AMENDED) An optical device to which an optical signal compressed on the time axis as propagating in an optical fiber is supplied, comprising:

a distributed feedback (DFB) laser; and

a circuit [for] supplying a current to said DFB laser so that said DFB laser oscillates at a first wavelength; said optical signal having a second wavelength different from said first wavelength, whereby said DFB laser applies a gain saturated in concert with an increase in input power to said optical signal, wherein said optical device changing spectrum of the optical signal.

14. (ONCE AMENDED) An optical device according to claim 13, further comprising a light source [for] supplying assist light having a third wavelength different from said first wavelength to said DFB laser.

15. (ONCE AMENDED) A system comprising:

an optical transmitter [for] outputting an optical signal;

a first optical fiber provided so that said optical signal is compressed on the time axis as propagating in said first optical fiber; and

an optical device to which a compressed optical signal output from said first optical fiber is supplied, said optical device having a saturated gain and changing spectrum of the optical signal.

16. (AS UNAMENDED) A system according to claim 15, further comprising a second optical fiber to which an optical signal output from said optical device is supplied.

17. (ONCE AMENDED) A system according to claim 15, wherein said optical device comprises a semiconductor optical amplifier [for] applying a gain saturated in concert with an increase in input power to said optical signal.

18. (ONCE AMENDED) A system according to claim 17, wherein said optical device further comprises a light source [for] supplying assist light having a wavelength different from the wavelength of said optical signal to said semiconductor optical amplifier.

19. (AS UNAMENDED) A system according to claim 15, wherein:

said optical device comprises a distributed feedback (DFB) laser and a circuit for

supplying a current to said DFB laser so that said DFB laser oscillates at a first wavelength;

said optical signal having a second wavelength different from said first wavelength, whereby said DFB laser applies a gain saturated in concert with an increase in input power to said optical signal.

20. (ONCE AMENDED) A system according to claim 19, wherein said optical device further comprises a light source [for] supplying assist light having a third wavelength different from said first wavelength to said DFB laser.

21. (AS UNAMENDED) A system according to claim 15, further comprising at least one optical amplifier provided along said first optical fiber;

the peak power of said compressed optical signal being set so as to become higher than a threshold power giving said saturated gain.

22. (AS UNAMENDED) A system according to claim 15, wherein:

said first optical fiber has normal dispersion; and said optical transmitter includes means for performing prechirping so that said optical signal has down-chirp.

23. (AS UNAMENDED) A system according to claim 15, wherein:

said first optical fiber has anomalous dispersion;

and

said optical transmitter includes means for performing prechirping so that said optical signal has up-chirp.

24. (AS UNAMENDED) A system according to claim 15, further comprising a dispersion compensator provided along said first optical fiber for compensating the dispersion of said first optical fiber.

25. (AS UNAMENDED) A system according to claim 16, further comprising a dispersion compensator provided along said second optical fiber for compensating the dispersion of said second optical fiber.

26. (AS UNAMENDED) A system according to claim 15, further comprising an optical phase conjugator provided in the vicinity of a point where the dispersion of said first optical fiber is substantially equally divided.

27. (AS UNAMENDED) A system according to claim 16, further comprising an optical phase conjugator provided in the vicinity of a point where the dispersion of said second optical fiber is substantially equally divided.